Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

CSAS | *SCCS*

Canadian Science Advisory Secretariat | Secrétariat canadien de consultation scientifique

Proceedings Series 2006/044 | Série des comptes rendus 2006/044

Proceedings of the Maritimes Regional Advisory Process of Scallop Stocks in Scallop Fishing Area 29

27 March 2006

Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Ross Claytor (Chair)

Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

Compte rendu de la réunion du Processus consultatif régional sur le stock de pétoncle de la zone de pêche du pétoncle 29

27 mars 2006

Institut océanographique de Bedford
Yarmouth, Nouvelle-Ecosse

Ross Claytor (Président)

Institut océanographique de Bedford
C.P. 1006
Dartmouth (Nouvelle-Écosse)
B2Y 4A2

March 2007 | Mars 2007

Canada

Foreword

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or miss-leading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

Avant-propos

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

Proceedings of the Maritimes Regional Advisory Process of Scallop Stocks in Scallop Fishing Area 29

27 March 2006

Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Ross Claytor (Chair)

Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

March 2007

Compte rendu de la réunion du Processus consultatif régional sur le stock de pétoncle de la zone de pêche du pétoncle 29

27 mars 2006

Institut océanographique de Bedford
Yarmouth, Nouvelle-Ecosse

Ross Claytor (Président)

Institut océanographique de Bedford
C.P. 1006
Dartmouth (Nouvelle-Écosse)
B2Y 4A2

mars 2007

© Her Majesty the Queen in Right of Canada, 2006
© Sa Majesté la Reine du Chef du Canada, 2006

ISSN 1701-1272 (Printed / Imprimé)

Published and available free from:
Une publication gratuite de :

Fisheries and Oceans Canada / Pêches et Océans Canada
Canadian Science Advisory Secretariat / Secrétariat canadien de consultation scientifique
200, rue Kent Street
Ottawa, Ontario
K1A 0E6

http://www.dfo-mpo.gc.ca/csas/

CSAS@DFO-MPO.GC.CA

Printed on recycled paper.
Imprimé sur papier recyclé.

Correct citation for this publication:
On doit citer cette publication comme suit :

DFO, 2006. Proceedings of the Maritimes Regional Advisory Process of Scallop Stocks in Scallop Fishing Area 29; 27 March 2006. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2006/044.

TABLE OF CONTENTS

Abstract / Résumé iv

Introduction 1

Overview of Working Paper 1

Summary of Results 2

Comments, Questions, Recommendations, and Discussion 3

Commercial Fishery 3

Research Survey 4

Lobster Bycatch 8

Stock Status and Advice 9

Stock Status 11

Appendix 1: Invitation Letter 19

Appendix 2: Meeting Remit 21

Appendix 3: Agenda 22

Appendix 4: List of Participants 23

ABSTRACT

These proceedings record discussions that were held during the Regional Advisory Process (RAP) meetings for Scallop Fishing Area (SFA) 29 scallop stocks on March 27, 2006. These proceedings record discussions that were held during the Regional Advisory Process (RAP) meetings for Scallop Fishing Area (SFA) 29 scallop stocks on March 27, 2006. This meeting was attended by members of the SFA 29 scallop industry, DFO Science Branch staff, and Fisheries and Aquaculture Management staff. This stock was last reviewed in 2005. A Science Advisory Report was reviewed at this meeting.

RÉSUMÉ

Le présent compte rendu relate les discussions tenues lors de la réunion du Processus consultatif régional (PCR) sur le stock de pétoncle de la zone de pêche du pétoncle (ZPP) 29, le 27 mars 2006. Cette réunion regroupait des membres de l'industrie de la pêche du pétoncle dans la ZPP 29 ainsi que des membres de l'équipe des Sciences et de la Gestion des pêches et de l'aquaculture du MPO. L'évaluation précédente du stock considéré datait de 2005. Un Avis scientifique a été examiné à cette réunion.

INTRODUCTION

The chair, Ross Claytor of the DFO, opened the meeting. The remit was identified as:

Assess the status of SFA29 scallop and provide TAC advice. The assessment should include:

- Provide TAC advice for SFA 29 scallop fisheries by area using analysis of catch rate and survey biomass trends.
- Provide an assessment of the potential for lobster by-catch in each area.

Stephen Smith, Mark Lundy, Sherrylynn Rowe, Doug Pezzack, and Cheryl Frail provided a working paper, 'Scallop fishing area 29: Stock status and update for 2006' as supporting documentation for satisfying the remit. A presentation by Stephen Smith summarized the material in the document and the results of side-scan sonar bottom mapping that resulted from a JPA with the scallop industry, NRCAN, and DFO.

External reviewers, Peter Amiro, Peter Hurley, and Angelica Silva provided initial comments on the working paper and presentation by section of the document. After these comments the chair opened the meeting to the floor for additional comments.

Reviewer reference numbers do not refer consistently to a specific individual. Written comments associated with a specific reviewer number do not necessarily match the reviewer numbers identified in the meeting comments.

Upon the completion of the review of the working paper, the bullets of Science Advisory Report (SAR) were reviewed.

OVERVIEW OF WORKING PAPER

The working paper consisted of the following sections: Commercial fishery, Research survey, Lobster bycatch, and Stock status and advice for 2006.

Fishery Background

The 2005 fishery opened 20 June and continued until 27 July with the exceptions of subareas B, C, and D which were closed on 22 July, 9 July, and 21 June, respectively, after having exceeded their respective quotas (Table 1). During 2005, a total of 253 t (189 t Full Bay; 64 t East of Baccaro) was landed against a TAC of 255 t. Prior to 2004, Subarea D had been closed to fishing because of the large number of young scallops in the subarea. The western half of Subarea D (west of longitude 65°40'W) was opened for the 2004 season after it was determined from the 2003 survey that there were enough commercial size scallops for a fishery. All of Subarea D was open for the 2005 fishery.

Average meat weights from the fishery ranged from 14.9 g to 27.7 g and were not appreciably different from those observed in 2004. Percentages of small meats (less than 8 g) continued to be extremely low.

Scallop Fishing Area (SFA) 29 encompasses a very large inshore area inside the 12-mile territorial sea, from the south of Yarmouth (latitude 43°40'N) to Cape North in Cape Breton. This report refers to only that portion of SFA 29 west of longitude 65°30'W continuing north to SPA 3 at latitude 43°40'N.

Prior to 1986, the Full Bay Scallop Fleet fished in this area. Following the 1986 inshore/offshore scallop fishing agreement, fishing by the Full Bay Fleet was restricted to north of latitude 43°40'N. A limited fishery by the Full Bay Fleet was granted from 1996–98. Access was again granted to this fleet in 2001 with a full at-sea monitoring program and with a condition of a post-season industry-funded survey. SFA 29 is within Lobster Fishing Area 34 and, as a result, scallop fishers consulted with lobster fishers in the area to deal with potential conflicts. Lobster by-catch was minimal in 2001 despite high scallop catch rates. Lobster bycatch continues to be monitored in this fishery.

In 2002, the Minister of Fisheries and Oceans approved access to this area by the Full Bay Fleet and inshore east of Baccaro licence holders who are eligible to fish in SFA 29 west of longitude 65°30'W. SFA 29 inshore scallop licenses were historically restricted to east of Baccaro (east of longitude 65°30'W). A joint project agreement was signed with the fishing fleets, Natural Resources Canada, and Fisheries and Oceans Canada with all parties providing funds to conduct multi-beam acoustic mapping of the seafloor and other scientific work. A map showing bottom features for the entire area has been prepared and was distributed to the fishermen for the 2004 fishery. Work continues on analyzing surficial geology and the spatial distribution of scallops.

Advice on TACs for this area has been provided annually and is based on tracking the response of survey estimates of abundance to catches in the previous year. There are no framework or reference points for the fishery in SFA 29 at this time.

SUMMARY OF RESULTS

- For the fifth consecutive year, a fishery was conducted in the portion of Scallop Fishing Area 29 west of longitude 65°30'W. Starting in 2002, the TAC was shared between the Full Bay Fleet and a limited number of inshore east of Baccaro licence holders who are eligible to fish in SFA 29 west of longitude 65°30'W (i.e., East of Baccaro Fleet).

- A total of 253 t (189 t Full Bay; 64 t East of Baccaro) was landed against a TAC of 255 t.

- Average meat weights from the fishery ranged from 14.9 g to 27.7 g and were not appreciably different from those observed in 2004.

- Average catch rate for the Full Bay Fleet was 41.8 kg/h over the whole area in 2005 compared to 54.4 kg/h in 2004. The average catch rate for the East of Baccaro Fleet was 27.1 kg/h over the whole area in 2005 compared to 32.0 kg/h in 2004.

- The annual survey indicates that biomass levels of commercial size scallop have remained fairly constant in subareas A and C with little recruitment to commercial size expected for the next three years. Biomass has increased in subareas B and D in 2005 with recruitment to the commercial size class expected in Subarea D for 2006.

- While a catch of 80 t in 2004 and 4 t in 2005 did not seem to result in a large decline in survey biomass, continued fishing in Subarea A in 2006 will probably be limited to scallops ages 6 and older due to limited recruitment.

- Evaluations of the impact of fishing were conducted using a population model for subareas B, C, and D. For example, catches of 75 to 100 t, 25 to 50 t, and 50 to 75 t would result in

less than a 50% chance of a decrease in the 2006 biomass relative to 2005 for subareas B, C, and D, respectively. Alternatively, setting catch levels such that the mean expected decrease was equal to zero would result in 150–200 t for Subarea B, 75–100 t for Subarea C, and 125–150 t for Subarea D.

- There was not enough survey information to recommend catch levels for Subarea E. This subarea appears to offer marginal habitat for scallop.

- Bycatch of lobster in SFA 29 was low in 2005.

COMMENTS, QUESTIONS, RECOMMENDATIONS, AND DISCUSSION

Comments and questions occurred throughout the discussion of the working paper. These have been organized by topic of the working paper. Sometimes the comment or question occurred and no answer or response was possible. These are left for future authors to consider for the next assessment. At other times, a response was possible and these are indicated.

Reviewer numbers do not always refer to the same individual but the order in which the comments were made. *Response* refers to a response from one of the working paper authors unless otherwise indicated.

COMMERCIAL FISHERY

Scientific Review

Reviewer #1

A general comment was that the industry had been placed in an ecological context. However, the re-distribution of organic material may be important. The introduction was terse and requires explanation and more background is required for a general audience.

The method section needs more explanation especially for habitat classification.

A table documenting the history of management regulations and when they changed is needed.

However, Smith and Lundy provided good background for the methods.

Selectivity and catchability issues were not well covered, in particular whether catchability varies with season. In Fig. 3, a box plot presentation would show annual variation.

Habitat and CPUE correlations were useful.

Statements referring to declining trends need to be supported by a method other than eye.

Positions need to be supported with analysis.

Response

Catch rate interpretation is visual, but given the complexities of the commercial logs it is not clear on how to present CPUE estimates. However, the gear has not changed over the last five years.

Reviewer #2

How long have the maps been available (since 2004) and how they may have influenced fishing patterns will be important in interpreting CPUE. This will likely lead to some increase in CPUE that will be difficult to quantify.

Reviewer #3

The introduction and history of the fishery from the 2004 document is comprehensive and a good overview and could be included here. This will be important for maintaining an historical perspective.

A table showing the history of meat weights is needed.

Floor Review

A history section could be included in the SAR.

RESEARCH SURVEY

Scientific Review

Review #1

The 2004 document was useful for background.

What is the rationale for the shell height intervals?

Monitoring of scallop condition, especially gonads would be useful.

Response

Regulation was 95 when the fishery started, then 100 after that. The age-groups are based on growth analysis. Table 6, shows the pattern over time.

Reviewer #2

A map of the surficial bottom type is needed or a reference to the distribution of surficial bottom type. Also how the surficial bottom type was determined needs to be referenced.

What is the sampling strategy? Is it random, random by management area, or random by bottom type.

The 2001 fishery seems to be an anomaly, with a decline from 2001 to 2002 in CPUE.

The discussion of comparative tows is not helpful. If the vessels are the same size, with same gear and power then there is more comfort. Five comparative tows are not sufficient.

Response

The analysis is not complete yet. Stations on bedrock not sufficient or useful. Vessels have been looked at individually and fishing power has been assumed to be equal for this first attempt. Making this assumption did not change the view of the stock.

Reviewer #2

An argument of fishing power equal among boats is a more powerful argument than tow by tow comparison.

Response

Comparative tows were not used. Two independent surveys was the method used.

Reviewer #2

There is an assumption that CPUE is a function of density, how are densities estimated?

Response

Standardized CPUE and the standardized tow is a unit of area. If we could assign densities based on habitat then this would reduce the variance on the estimate.

In the future bottom type will determine the survey design.

Reviewer #2

Is there a source of immigration to the harvested area?

Are there naturally protected areas that cannot be fished?

These things may make it difficult to estimate recruitment. If scallop occur in the bottom between ridges and cannot be fished this could be a source of uncertainty.

Response

Scallop tend to be found on bottom with a sand layer. Larvae have some ability to select bottom type.

Reviewer #3

The survey has been going on for 5 years, usually we cannot do anything so soon with that length of time series.

Vessel calibration analysis needs to be completed. There is a need to reflect this in the uncertainty.

Response

We used the Julie Ann Joan for all trends and gave up certainty to prevent bias.

Reviewer #3

How will size-class and bottom type be incorporated in the future? How mobile are they?

Response

Growth varies by bottom type but not necessarily by year-class. Older scallop are not mobile. Scallop have different habitat needs as they age.

Reviewer #3

Fig. 16 is biomass but table 6 is in numbers. Why not show both in biomass. Does the survey track cohorts?

Response

Cohort tracking was looked at two years ago and it was not good at tracking. We went to a dynamic pool model and different bottom type requirements by age may influence tracking.

Unless we have higher sampling within these areas, we are unlikely to be able to track cohorts. Cohorts are very aggregated.

Reviewer #3

Do surveys and fishery together track cohorts? Recruitment seems episodic. Most of the time there seems to be a stock – recruitment function but every so often a boom occurs. Low recruits seem to have low residual populations.

Industry Response

Booms seem to follow a period of lows.

Response

In the Bay of Fundy, strong recruitment comes from low numbers, this is not unusual for molluscs, especially bivalves. These require the co-occurrence of a number of favourable factors.

Reviewer #3

What is the age at maturity?

Response

6+ up to age 12-14.

Reviewer #3

Clappers can be a proxy for M. Can this be done for an age-based model?

Response

Small shells break apart easier than big shells making estimates uncertain.

Floor Review

Area C only 18-19 tows. On the South east side of C and the western side of D there is not much sampling. There was no survey where the fishery occurred.

Response

Better coverage is needed. VMS records and density from previous years could be used to guide sampling strategy.

Floor Review

Is it possible that these have lead to under-estimates?

Similar trends occur regardless of sampling strategy.

Response

The impact of fishing in Area D identified last year may be overstated.

Floor Review

On page 5, it indicates a full anlaysis is pending. The Julie Ann Joan did catch more scallops.

Response

Yes but only for certain bottom types. Two vessels fishing together provide the same trends. Adding stations would provide the same estimate with a smaller variance.

Floor Review

The high incidence of clappers occurs in an area of 36 hour fishing. What is the trend in clappers?

Response

This seems to be a function of more scallops rather than higher mortality.

LOBSTER BYCATCH

Reviewer #1

Conclusions would be stronger supported by remote camera work.

Response

Good idea.

Reviewer #2

This presents a clear picture of bycatch over the last 5 years. The number of lobsters in the bycatch seems to have decreased.

Reviewer #3

Shell hardness is not given the in the document. It is not clear that the information comes from two data sources, the fishery and the survey. The data seems to be insufficient and the survival of those released is unknown. Mortality of those not observed is unknown. Contribution of shucking is not known. The amount of illegal lobster gear during the scallop fishery is not known.

Research requirements need to be better defined. What would the signal be six years from now that something bad was happening or had happened? There may be small-localized effects. It seems that strategically something can be reduced, especially in areas of high concentration.

There is no information presented on uncertainty in by-catch estimates.

Is there a requirement for a closure?

Response:

When catch of lobster exceeds a certain point, they can only fish with an observer.

The triangle for exclusion and observer requirements are not defined by science.

The signal expected to see in the future is a major change in landings.

The catch of lobster as by-catch is a small percentage of the lobster fishery catch.

Study of by-catch by all fisheries is the intention.

Study of unfished areas are needed.

Other scallop surveys are coming up with similar estimates.

In late August, the dead animals go way up. In recent years the fishery has been in June – July so injury and death are lower.

Observers report incidence to area office.

Floor Review

When an observer is required there is less fishing activity.

Draggers take many more lobsters per tow and any study should include all fleets.

There is a long-time scallop fishery in the area to the north. These areas could be examined for long-term effects.

Observers should be instructed to look at shell conditions. These could be segregated on a weekly or bi-weekly basis.

Fishing could also occur before lobsters begin to molt.

The effect of illegal fishing on the lobster stock should also be considered.

Survey is being done when lobsters are most vulnerable.

The agreement with the lobster industry was that when a certain amount of lobster showed up that it would constitute a closure.

Recommendations from Industry

Display results on lobster by-catch by week.

Collect by-catch data from all fisheries, including illegal fisheries.

Surveys could be done at the end of the fishing season.

STOCK STATUS AND ADVICE

Reviewer #1

There seems to be an increasing trend in catchability for Area D.

Response:

This is a result of changing bottom type.

Reviewer #1

M is decreasing by a factor of 2 in Fig. 29.

Response:

This is a function of model structure. M tends to follow abundance.

Reviewer #2

Catchability is estimated by area by year. There are a lot of estimates with few years of data. Would expect observed and predicted to be quite well done. Comparing observed and predicted not that informative.

It seems that all predicted values are positive.

Growth is averaged over the area, is this appropriate?

Response

Observed and predicted is not the best way to evaluate. Bay of Fundy assessment looks at how well it predicts following year.

Reviewer #2

There is no strong recruitment and cohort tracking seems to be a problem.

Show 25th percentile or the risk adverse point, show 75th percentile risk prone point.

Response:

Inshore scallop actions are a joint decision of managers and industry. Capturing all uncertainty is desirable including model uncertainty. The model is sensitive to recruitment. Trend is survey and CPUE are similar, indicating large areas have not been missed.

Reviewer #3

Will availability of bottom mapping affect catchability? Similar 2003 and 2005 same proportion of bottom type sampled.

How do results compare to those that would have been obtained last year if this model were used.

Response:

First time the advice has been presented in this way.

Floor Review

At what point do M and growth show a decline. Map out animals 5 to 8 years old. At what strategies do we give up on yield per recruit.

Response

A conservative scenario bets that more yield will result by leaving scallops in the water and allow for growth. An aggressive approach will keep the population where it is.

Floor Review

Large scallops could be a driver for the population then.

Response

Yes, older animals tend to have healthier eggs.

Floor Review

How important is it to protect against high number of clappers. In 1986, they all died.

Response

When there was good growth in Lurcher, we did extend catch to take advantage of this.

Floor Review

The advice is presented in terms of ranges of tonnages and the effect this will have on biomass next year.

Response

These are presented in the table.

Floor Review

Risk adverse, is the 50% probability that biomass will be the same or greater.

Response

These are presented in the table.

Considerable discussion occurred about how to interpret the table. Stephen agreed to make some changes to make the table clearer and these will be incorporated in the SAR.

STOCK STATUS

Evaluations of the impact of fishing were conducted using a population model for subareas B, C, and D. For example, catches of 75 to 100 t, 25 to 50 t, and 50 to 75 t would result in less than a 50% chance of a decrease in the 2006 biomass relative to 2005 for subareas B, C, and D, respectively. Alternatively, setting catch levels such that the mean expected decrease was equal to zero would result in 150–200 t for Subarea B, 75–100 t for Subarea C, and 125–150 t for Subarea D.

There was not enough survey information to recommend catch levels for Subarea E. This subarea appears to offer marginal habitat for scallop.

Written Comments were submitted by two external reviewers and are included below:

First reviewer (not equivalent to Reviewer #1 in discussions above)

Commercial fishery

1. Fig 5 not much difference in commercial catch rates between bottom types?

2. If bottom type maps were available before the 2005 fishery, this might lead to changes in efficiency in 2005 fishery – this could affect c/e – without analysis of this, our harvest strategy should be more conservative

Research Survey

1. We usually indicate that we can't do much with a resource abundance survey before a 5 year time series is in place. Impressive what has been done in this case in year 5

2. Is survey pre-fishery or post Fig 16/17 vs Fig4/5

3. No vessel calibration available as yet – our harvest strategy should be more conservative

4. How many age groups in ages 6+, what is the age of 50% maturity

5. Should incorporate GIS and spatial analysis into assessment and should relate bottom type to size class/age relationship

6. Should do analysis to demonstrate that cohorts track in research survey?

7. Table 6 Area 29A <100mm doesn't track with >100m, how to reconcile Fig 6 90-100mm and Fig 7 100+mm abundance

8. Clappers – explain what clappers are, is there an opportunity to use clappers to estimate Z at age

Lobster Bycatch

1. Effects on lobsters on bottom unobserved, should employ remote camera to evaluate effect on lobsters not captured by trawl

2. Fig 15 2004 survey ? Branntelle – vessel effect? Error estimates would likely demonstrate no significant trend across other years, should be conservative until vessel comparison complete

3. Explain consequence of increasing trend in q in Fig 28

4. Explain consequence of trend in M in Fig 29

5. Table 9 error? Observer data Meats (t) > Fishery Meats (t) ??

Second reviewer (not equivalent to Reviewer #2 in discussions above)

Scallop fishing area 29: Stock status and update for 2006 by Stephen J. Smith, Mark J. Lundy, Sherrylynn Rowe, Doug Pezzack and Cheryl Frail

Overview

This reviewer found the subject of assessment of scallops a challenging and interesting piece of fisheries science and in a perverse sense enjoyed delving into other assessment researchers problems. It was not unfamiliar water.

Estimates of the numbers of scallops rather than the weight of meats in mt (?) was appreciated and is a positive step to placing this animal and this fishery in an ecological context. The fact that meats represent roughly 25%(?) of the organic material in a scallop is worth mentioning. The redistribution of the discarded organic material would seem to be a topic for consideration.

The use of the past perfect tense when the simple past tense would have been perfectly adequate combined with a number of industry or species specific jargon terms does not improve the readability of the document. Suggestions to improve readability will not be covered in the written review. The authors are welcome to the scratch sheets.

The introduction was too terse to be useful. How long was the areas closed before 2001? Did the 2001 fishery fish down the stock or was it based on only one yearclass? The document would also benefit from a methods section, especially for data and analysis that cross other sections for example habitat classification and biomass estimates.

The document would benefit from a tabling of the management regulations in effect annually and the variation orders modifying those regulations. A description of some of the conditions of the fishery came in the Research Survey section (Pg5P1). Also, the description of the gear and potential selectivity was not mentioned and hindered an evaluation of the data presented. The background documents provided in depth review and sound postulates for assessment and management options based on current and leading edge modeling methods. The difficulties in describing a rational fisheries management model for a species of undetermined recruitment origins and states were much appreciated. However, in general this document was difficult to follow because many of the background and methods were not presented or repeated in this document or always referenced. A review of Smith and Lundy (2002) was required in order to appreciate the modeling presented. Minimally the formulations of all state variables and source of all imported coefficients need to be presented or referenced. One assumes that Bt is the residual biomass of recruited scallops after the fishery as estimated from the research survey catch and an assumed *q*. This requires stating previous to or on page 6 when the term is first introduced.

The conclusions of the document appear somewhat contradictory. The document p5 par 7(? Last sentence) states that "*Presently, there are no strong recruitment signals for any of the areas.*"

Yet the document and the SSR states "*The annual survey indicates that biomass levels of commercial size scallop remained fairly constant in Areas A and C to 2005. However, based on the observed numbers of pre-recruit scallops in the research survey in 2005 low recruitment is expected for the next three years in these areas. Biomass increased in Areas B and D in 2005 and based on the research survey recruitment similar to past years is expected in Area D for 2006.*"

The Stock Status and Advice for 2006 section then states "*Advice on TACs for this area has been loosely based on tracking the response of survey estimates to previous year catches.*" This analysis was not presented.

The equilibrium analysis as presented indicated probability neutral TACs that are greater than recent TACs. This does not seem reasonable given the assessment. Provided that this reviewer understood the modeling presented it is uncertain whether the data support the recommendations one way or another. The output provided was clearly bias and because every q_i is estimated by the model and the state variables estimated from q_i's , model fits are be expected to be accurate but not bias as indicated by the output. Therefore, the scaling fractions like the growth parameters must be incorrect. It was difficult to assess whether non-recruited scallops or the residual recruited scallops carried the harvest and how they weighed in the equilibrium model. Therefore it was impossible to determine the contribution of Rt to the harvest and effect of selectivity or immigration (recruitment from outside an area) to a harvest area. Certainly there is no simple statistical significant relationship between pre-recruits and recruits the year following in the numeric data presented in Tables 6 and 7 even though the habitat classification seemed to add order to the data. Notable in this data was the fact that low pre-recruits were more frequently followed by low recruits the following year. Yet another fisheries example that recruitment is not spontaneous and that strong year classes can sometime occur from weak spawning stock biomass. Models and management systems that capture this phenomenon are prime research topics for this fishery.

Based on the information provided it may be useful to restructure the delay difference equilibrium model such that estimates are not biased and then offer 25^{th} , 50^{th} and 75^{th} percentiles of the likelihoods as management options. Furthermore, based on the uncertainties in the estimate of pre-recruits , the low numbers of pre-recruits observed in 2005 and the ability for in-season assessment a management based on an opening TAC's for 2006 using the 25^{th} percentile or lower and readjust if initial catch rates are high and stable would seem prudent. A temporal estimate of q_i' would be useful in this regard.

Technical Points

The fact that Fisheries Management was forced to close the fishery in some areas after only 36 hrs suggests that catch rates are highly variable and perhaps functionally decay through a season. Because catch rates are fundamental to estimate the residual and perhaps the pre-recruit population examination of the effects of variable or functional q's on the estimate of biomass or recruitment seems warranted.

Stability as a result of differing trends (Pg4P5) is an awkward concept. Figure 3, which is really the mean standardised catch rate (kg/h) would be better presented as box plots revealing the instability of annual overall means. One assumes that kg/h is the standardisation and kg/tow is the base data the document does not state.

In general the use of "trends" to mean serially connected scatter plots does not meaningfully interpret the figures. "Trends being smoother" (Pg 4P5) really meant lower variance in catch rates organised in a different way. More discussion in the correlation in catch rates between areas or habitats seemed warranted as potential way to improve the fisheries model.

A map of habitat types and the data and models used to assign habitat type would have been useful.

The discussion on comparative tows was not helpful. Regardless whether comparative tows were made or not a statement on the potential fishing power of the vessels could have been presented. One is left to presume that similar gear, similar speed and similar conditions applied to both vessels. It is not certain whether relative differences in comparative catches would add or detract anything to the methods used for assessing this species in these areas. It would

seem that the sparse data would not be informative or whether the assessment is sensitive to these differences.

Rather than a comparison of two sampling strategies three strategies were mentioned in the document.

The use of "densities' (Pg5 P4) sort of snuck in there. Are densities of scallops ever estimated? Perhaps they need to be.

Are there scallops between long narrow ridges where sampling could not be completed. Are these natural refuges to commercial dragging? Are these a significant source of immigration to the harvested areas? Are they protected?

Could Pg6 P1 read "Unlike the commercial catch rate the change in stratification...."?
The notable thing about Figure 15 is the drop in 2004 not the increase in 2005. How was biomass estimated? What is it... the residual biomass?

Lobster Bycatch

In general analysis of the lobster data is not presented. One assumes that there is size, sex, ripeness and shell hardness data that were analysed but not presented. The figure reference in Pg6P5 is wrong Figure 24 is being referred. Information on shell hardness would be very interesting. In general the information to suggest minimum impact on the lobster population and subsequently the lobster harvest effected by the scallop fishery is insufficient. The survival of released live lobsters, non-catch mortality of lobsters attributed to dragging, increased growth and biomass of lobsters attributed to at-sea scallop shucking and deterrence of illegal lobster gear all potentially contribute to a risk assessment of the impact of scallop fishing on lobster population. The statements made (Pg7P1) are not supported by analysis or a relative risk assessment but only on a visual interpretation of the data. The casting ahead of a potential problem (Pg7P2) requires some explanation and expectation. When would one expect to see an effect? What would the signal be?

The single sentence "Data from the scallop surveys...." needs to be moved to P1 to support the opening statement of Pg7 P1.

Sentence one in Pg7P3 is so obvious as to be not informative. The second sentence is not supported by any fact presented. While it may be common sense and precautionary to avoid collateral damage to lobsters by scallop dragging there remains a needd to quatify the impact in some way and estimate the value of closed areas in reducing impact. The background data, analysis and advice for the closed triangle presented in Figure 21 is not presented but it is apparent that the triangle does not capture the concentration of lobsters observed in the fishery. The final two sentences of the paragraph state the obvious but provide no indication of the science available to support the conclusion that lobsters are aggregated in the area when molting and are more vulnerable to the gear and are more like to be irrevocably harmed.

Stock Status and Advice for 2006

The first sentence needs a reference to a figure(s) and table(s) and possibly an analysis other than by eye.

The previous method for assigning TACs is not presented and is intractable.

See Overview comments for this section.

Conclusions

There is no conclusion section and there needs to be. It would be helpful to include the research recommendations in this section as well. Some are buried in the document but no overall assessment of the vulnerabilities of the methods, data, or management interactions with science are presented.

Third reviewer (not equivalent to Reviewer #3 in discussions above)

1. General Comments
    - Overall, the Research Document for area SFA 29 provides a very comprehensive synthesis of the 2005 scallop fishery, the research survey, lobster by-catch and the stock status and advice for 2006.
    - For consistency, consider maintaining the continuity of historical information, structure and flow of the document as it has been part of the Research Document in earlier years (for each of the sections). A consistent structure would be of benefit to those that work or have an interest in this fishery and it will facilitate yearly updates of information.
    - Research Survey section: consider starting this section with a description and update of methodology used for the design of the post-season research survey. New knowledge of bottom mapping have changed survey design and monitoring of catch rates, meat weights, etc. on the basis of bottom type and it would be useful to maintain both perspectives at all times (bottom type and area) when possible.
    - Presenting a series of at least the most recent 2 years of mapped spatial distribution of scallops from 65- 79 mm to >100 mm, would be of benefit to the reader to visualize overall status of shell height distribution.
    - Whenever possible provide quantitative qualification of variables and or trends.
    - With regard to scallop research in SFA 29, an area that could be useful for decision making and conservation of the stock would be scallop condition for areas C and D in particular.

2. Introduction
    - To maintain continuity consider adding relevant part of the 2004 Introduction to 2005 introduction.
    - For consistency, add lat and long of the geographic location in Cape Breton (12 miles offshore) when describing extent of SFA 29.

3. Commercial Fishery
    - Start description of fishing period by providing extent of fishing period for the whole area i.e. June 20 to July 27, before describing individual sub-areas.
    - Consider keeping flow for this section as provided in 2004 as it moves from the more general aspect of fishing (vessel monitoring, TAC, commercial catch rates) to a more specific aspect of the monitoring that is Meat weight sampling.
    - First paragraph: Need to verify numbers in Second paragraph reads 'Total landings ...were 253.5 t"; but Table 1 shows a total landing at 253.3? Check Table 1 for consistency, keep 1 decimal or none.
    - Third paragraph: a reference made to TABLE 3 (statistics from meat weight samples) before introducing Table 2 (catch rate), which is found in next paragraph. I think this

is due to the change in flow from last year's Research Document, therefore either maintain the 2004 flow or change number for the table.

- Third paragraph: Second sentence includes a comment on the comparison of average meat weights between 2004 and 2005 for each area, and describe it as "not appreciably different", but they appear different (10% or greater change) when comparing with Table 3 from 2004. Here it would be helpful to include the 2004 relevant table 3 since when comparing the average meat weight for both fleets, it appears to vary with area and fleet. For example, in comparison with 2004, the 2005 average meat weight for the Full Fleet have greater average meat weight in area A (12%), lowered in areas B and D (14% and 18%, respectively) and at the same level than 2004 in area C. The East of Baccaro fleet in 2005 lowered its average meat weight in area a (26%) and area C (10%), but increase it in area B (18%).
- Fourth paragraph: First sentence, should add FIG 2 (not in the text of original document), before Fig.3. Third sentence, delete "and" that appears twice, add Table 2 from 2004 or indicate % increase/decrease from 2004 since it varied greatly.

4. Research Survey
   - Second paragraph describes the groupings of scallops shell height and its correspondence to age. These 2005 grouping for analysis purpose and for display of results are different that 2004, and although this is a valid change an explanation should be included in the document. Furthermore, commercial size was redefined to >100mm (in 2004 it was >110mm). Check caption for Figs 7, 8,and 9 for consistency with range given in text. Effect of grouping on estimates of numbers and biomass?
   - 6th paragraph, add to commercial scallops >100mm in fig 6
   - 7th paragraph, add to Mean numbers of recruits (90-100mm); FIG7, check caption to read from 90-100 mm.
   - 8th paragraph: Figs 8 and 9, check captions to read 80-90mm and 65-80mm, respectively.
   - 10th paragraph: First sentence, Shell height frequencies for each area indicates that...Second sentence, Fishing was not allowed in area D until 2004...Third sentence, "Presently, there are no strong recruitment signals for any of the areas" should clarify that this is in reference to pre-recruits.
   - 11th paragraph: Fig 16 (A,B,C and D) could it include smaller size classes? In 2004, the Survey biomass index was presented as kg/tow; this year (2005) the Survey biomass index is in tonnes (t), why was it changed would it be possible to keep the old index as well as the new index?
   - Additional comment: In 2004 there was a Table 4 with "Mean numbers per tow for scallop surveys in scallop Fishing Area 29" for the shell height groupings of that year which shows a decreasing trend in mean number of scallop per tows. In this year 2005, a new table Table 6 "Survey total numbers index (thousands) in scallop fishing area 29 stratified by management area" is presented and shows fewer numbers of total tows in 2004 for B, C, and D. For comparison purpose, could a Table with mean number per tow be presented for 2005 that also had a column for <65 mm like in 2004?

5. Lobster Bycatch
   - Substantially more information was presented this year, 2005 with regard to this issue, a very comprehensive effort that needs to continue to be monitored.

6. Stock Status and Advice
   - Past efforts to predict scallop productivity and hence harvesting advice has been "loosely based on tracking the response of survey estimates to previous years

catches" (Smith et al. 2006), an approach that has been used from 2001 to 2004 in SFA 29.

- Recent information on the mapping of bottom type is showing that substrate type is one of the main physical factors that affect scallop aggregations and spatial distribution, but little is yet known about the biological and physiological responses of scallops to different environments in terms of growth rates (shell height, meat weight), sexual maturity, and mortality. Areas C and D appears to be the most dynamic in terms of recruitment during these 5 years (2001-2005), investigating biological responses of these scallops would be useful to incorporate growth and mortality rates for these specific areas into the model.
- A great effort have been made on the use of a model previously developed for SPA 4 that could help predict the potential TAC for SFA 29 for the upcoming year under various catch scenarios. It would be helpful to expand the explanation about the examination of the various generated scenarios to sustain the population of scallops in area SFA 29. It appears that the option of catches that would result in less than 50% chance of a decrease in the 2006 biomass for areas B, C and D are the more sustainable, but this is not clearly stated.

7. Other Comments
    - Enjoyed reviewing the research document and learning about SFA 29 scallops, thanks for the opportunity.

APPENDIX 1: Invitation Letter

Population Ecology Division
Maritimes Region, Science Branch
Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Scotia, B2Y 4A2
(TEL: 902 426-3573)
(FAX: 902 426-1862)

13 March 2006

Distribution

Subject: Stock Assessment Update of SFA 29 West of 65°30'

The stock assessment update for scallops in SFA 29 will be reviewed in the Needler boardroom of the Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, Nova Scotia, 27 March 2006, commencing at 9:00 am. The meeting's terms of reference are attached.

The purpose of the review is to consider the assessments' data inputs, to examine the scientific approaches of the stock assessments, to identify any weaknesses in data and/or methodology, to help improve the clarity of the assessments, and to make recommendations for further research. It will include a detailed examination of the stock assessment and writing of the Stock Status Report.

Copies of the assessment and the draft stock status report will be sent to participants one week before the meeting. At the meeting, DFO science staff will provide a brief overview of the assessments, which will include the main conclusions, the supporting evidence, any new methods, and major limitations. The presentation will be followed by discussion among the participants. The finalised stock status report will be prepared at the meeting. The minutes of this meeting will be published as a proceedings.

I would appreciate if you could confirm your attendance with Daisy Williams at (902) 426-3573 (WilliamsD@mar.dfo-mpo.gc.ca).

We greatly appreciate your contribution to this valuable exercise.

Original signed by:

Ross Claytor
Meeting chair

Attachment

cc : RAP Coordination Committee
D. Williams
R. O'Boyle
V. Myra

Distribution

Science	***Government - Others***	***Industry***
Mark Lundy	Maureen Butler, Maritimes	Keith Amero
Peter Amiro	Jim Jamieson, Maritimes	Kevin Amireault
Stephen Smith	Bruce Osborne, NS	Vance Hazelton
Ross Claytor	Ian Marshall, DFO, Yarmouth	Thomas O'Neil
Peter Hurley		Klaus Sonnenberg
Angelica Silva		R.G. (Dick) Stewart
Doug Pezzack		Glen Wadman
Cheryl Frail		Brian Giroux
		Ashton Spinney
		Kevin Ross
		Terry Baker, ENS
		Jeff Wagner, SWNS
		Chief Stewart Paul/ Dave Bolivar, Tobique First Nation
		Chief Roger Atwin/ Michael Power, Oromocto First Nation
		Chief Deborah Robinson/ Curtis Falls, Acadia First Nation
		Chief Brian Toney/ Holly MacDonald, Annapolis Valley First Nation
		Chief Blair Francis/ Blair Bernard, Eskasoni First Nation
		Chief Lawrence Paul/ Adrain Gloade, Millbrook First Nation
		Chief Terrance Paul/ Mike MacIntyre, Membertou First Nation

APPENDIX 2: Meeting Remit

REMIT

Meeting of the Maritimes Regional Advisory Process on SFA 29 Scallop Stock

27 March 2006

Needler Boardroom
Bedford Institute of Oceanography
1 Challenger Drive
Dartmouth, Nova Scotia

SFA 29

Assess the status of SFA29 scallop and provide TAC advice. The assessment should include:

- Provide TAC advice for SFA 29 scallop fisheries by area using analysis of catch rate and survey biomass trends.
- Provide an assessment of the potential for lobster by-catch in each area.

APPENDIX 3: Agenda

PROPOSED TIMETABLE

Stock Assessment Update of SFA 29
West of 65°30'

27 March 2006

Needler Boardroom
Bedford Institute of Oceanography
1 Challenger Drive
Dartmouth, Nova Scotia

Thursday, 17 March 2006

09:00:	Introduction
09:10-10:00:	SFA 29
10:00-10:30:	Break
10:30-11:00:	Review
11:00-12:00:	SSR
12:00-13:30:	Lunch
13:30-15:00:	SSR

APPENDIX 4: List of Participants.

Area code = 902 unless otherwise indicated.

Name	Organization	Phone	Fax	e-mail
Amiro, Keith	Full Bay Scallop Assoc.	245-2083		
Amiro, Peter G.	DFO	426-8104	426-8814	amirop@mar.dfo-mpo.gc.ca
Baker, Blair	ESFPA	889-2428		
Baker, Terry	ESFPA	889-2869		
Baker-Stevens, Nellie	ESFPA	889-2564		esfps@accesswave.ca
Bertram, Doug	Full Bay Scallop Assoc.	837-5163		
Bollivar, David	Necoot-Cook Fisheries	506-662-3805	506-662-3712	David.bollivar@ns.sympatico.ca
Butler, Maureen	DFO Resource Mgt.	426-9856	426-9683	butlerm@mar.dfo-mpo.gc.ca
Chisholm, Amy	DFO	426-5342		chisholma@ mar.dfo-mpo.gc.ca
Claytor, Ross	DFO Science	426-4721	426-1506	claytorr@mar.dfo-mpo.gc.ca
D'Entremont, Geoffroy	Full Bay Scallop Assoc.	742-9650		
Frail, Cheryl	DFO Science	426-5448	426-1862	frailc@mar.dfo-mpo.gc.ca
Fry, Joy	Full Bay Scallop Assoc.	742-9101	742-1287	aherring@ns.aliantzinc.ca
Giroux, Brian	SFA 29	742-6732	none	sfmobile@ns.sympatico.ca
Halliday, Michael	Full Bay Scallop Assoc.	245-1875		
Hazelton, Vance	Full Bay Scallop Assoc.	245-5712	245-2721	Vah@ns.sympatico.ca
Hines, Robert	SFA 29	723-0283	none	none
Hurley, Peter	DFO	426-3520	426-1506	hurleyp@mar.dfo-mpo.gc.ca
Illegible		532-5633		
Longmire, Anthony	Full Bay Scallop Assoc.	526-0976		
Longmire, Brian	Full Bay Scallop Assoc.	532-5634		
Lundy, Mark	DFO	426-3733	426-1862	lundym@mar.dfo-mpo.gc.ca
Nickerson, Bernie	SFA 29	742-9315	742-8690	overxonbay@yar.eastlink.ca
O'Neil, Shane	DFO	426-1579		oneils@mar.dfo-mpo.gc.ca
Pezzack, Douglas	DFO	426-2099	426-1862	pezzackd@ mar.dfo-mpo.gc.ca
Risser, Junior	SFA 29	766-4030		
Ross, Kevin	Full Bay Scallop	245-6528	245-5070	none
Rowe, Sherrylynn	DFO	426-8039		Rowes@mar.dfo-mpo.gc.ca
Silva, Angelica	DFO	426-6525		silvaa@mar.dfo-mpo.gc.ca
Smith, Stephen	PED / BIO	426-3317	426-1862	smithsj@mar.dfo-mpo.gc.ca
Spinney, Ashton	LFA 34	643-2490	643-2490	none
Stewart, Dick	Full Bay Scallop Assoc.	742-9101	742-1287	aherring@ns.aliantzinc.ca

Name	Organization	Phone	Fax	e-mail
Sweeney, Anne	A/ Area Director – SWNS DFO	742-0871	742-6893	sweeneya@ mar.dfo-mpo.gc.ca
Tabor, Craig	Millbrook	843-0401		
Tremblay, John	DFO Science	426-3986	426-1862	tremblayj@mar.dfo-mpo.gc.ca
Wadman, Glenn A.	D.B. Kenney	839-2023	839-2070	glennw@dbkenneyfisheries.com
Whitman, Bill	NSFA	424-0336		whitmane@gov.ns.ca